

selected in organisms that did not read written texts. It must be the product of self-reorganization of prior processing areas in organisms that had to adapt to and become adept at reading written characters.

7. DISCOVERING AND TESTING MODELS OF MECHANISMS

So far I have focused on articulating what are mechanisms and mechanistic explanations so as to make it clear what biologists, including cell biologists, are pursuing in their investigations. I have not said anything about the processes of discovering and evaluating claims about mechanisms. Because these are the prime activities of scientists, I turn next to the question of what can be said about these processes.²¹

The very conception of a mechanism sets the goals for its discovery – the investigator must identify the parts of the mechanism, determine what operations they perform, and figure out how they are organized to generate the phenomenon. Earlier I introduced the notion of *decomposition*, but emphasized the conceptual side of decomposition. To develop a model of a mechanism, a theorist decomposes it conceptually into parts and operations. But discovering a mechanism usually results from experimental engagement²² with the mechanism. I differentiated two ways researchers decompose mechanisms – structurally or functionally – depending on whether they focus on component parts or component operations. As we turn to experiments, these two types of decomposition now correspond to two types of experimental

²¹ Logical empiricists typically rejected the possibility of philosophical analysis contributing to understanding what Reichenbach (1966) called the context of discovery and instead focused on the context of justification, where it was thought that logic could characterize the relation of evidence to hypotheses. Interest in discovery was rekindled around 1980 (Nickles, 1980a; Nickles, 1980b). See in particular Darden (1991), who focuses on discovery in the context of theory revision. When mechanisms are the focus, it turns out that quite a bit can be said about scientific discovery.

²² Another set of experiments aim simply to establish the phenomenon for which a mechanistic explanation is sought. Experimentation designed to assess the phenomenon itself generally does not try to take the mechanism apart, but rather seeks to determine regularities in its behavior by establishing relations between inputs to the mechanism, conditions of its operation, and output. This involves measuring the values of relevant variables and, often, the manipulation of some variables. Lavoisier and Laplace (1780), for example, established the similarity of respiration by animals and ordinary combustion by placing respiring organisms or burning coal in a calorimeter and measuring the amount of carbon dioxide produced and of ice melted. This only involved setting up appropriate conditions for measuring the relevant variables. Pasteur (1861), on the other hand, determined that fermentation was an anaerobic phenomenon by manipulating the presence or absence of oxygen and showing that fermentation was suppressed in the presence of oxygen.